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IS/QC 410101 (1992): Potentiometers for Use in Electronic Equipment Blank Detail Specification: Lead-Screw Actuated and Rotary Preset Potentiometers Assessment Level E [LITD 5: Semiconductor and Other Electronic Components and Devices]

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Indian Standard

POTENTIOMETERS FOR USE IN ELECTRONIC EQUIPMENT
Blank Detail Specification:
Lead-Screw Actuated and Rotary Preset Potentiometers
Assessment Level E

UDC 621.317.727.2:621.38.038

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POTENTIOMETERS FOR USE IN ELECTRONIC EQUIPMENT

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Assessment Level E

NATIONAL FOREWORD

This Indian Standard which is identical with IEC Pub 393-2-1/IEC QC 410101 : 1989 'Potentiometers for use in electronic equipment — Part 2: Blank detail specification: Lead-screw actuated and rotary preset potentiometers: Assessment level E', issued by the International Electrotechnical Commission (IEC) was adopted by the Bureau of Indian Standards on the recommendation of the Resistors Sectional Committee (LTD14) and approval of the Electronics and Telecommunication Division Council.

In the adopted standard certain terminology and conventions are however not identical to those used in Indian Standards. Attention is particularly drawn to the following:

a) Wherever the words 'International Standard' appear, referring to this standard, they should be read as 'Indian Standard'.

b) Comma (,) has been used as a decimal marker while in Indian Standard, the current practice is to use a point (.) as the decimal marker.

In this Indian Standard, the following International Standards are referred to. Read in their respective place the following:

International Standard	*Corresponding Indian Standard*
IEC Pub 393-1:1989 Potentiometers fo use in electronic equipment, Part 1 : Generic specification	IS QC 410000 : 1992 Potentiometers for use in electronic equipment. Generic specification
IEC Pub 393-2:1989 Potentiometers for use in electronic equipment, Part 2 : Sectional specification: Lead-screw actuated and rotary preset potentiometers	IS QC 410100 : 1992 Potentiometers for use in electronic equipment. Sectional specification: Lead-screw actuated and rotary preset potentiometers

The technical committee responsible for the preparation of this standard has reviewed the provisions of the following International Publications and has decided that they are acceptable for use in conjunction with this standard:

IEC Pub 63 : 1963 Preferred number series for resistors and capacitors

IEC Pub 410 : 1973 Sampling plans and procedures for inspection by attributes

This standard is intended primarily for use under the IECQ system. A regular Indian Standard for this component could be different, identical or similar to this standard.

Only the English language text in the International Standard has been retained while adopting it in this standard.

INTRODUCTION

Blank detail specification

A blank detail specification is a supplementary document to the Sectional Specification and contains requirements for style and lay-out and minimum content of detail specifications. Detail Specifications not complying with these requirements shall not be considered as being in accordance with IEC Specifications nor shall they so be described.

In the preparation of detail specifications the content of Sub-clause 1.4 of the Sectional Specification should be taken into account.

The numbers between brackets on the first page correspond to the following information which shall be inserted in the position indicated.

Identification of the detail specification

(1) The "International Electrotechnical Commission" or the National Standard Organization under whose authority the detail specification is drafted.

(2) The IEC or National Standards number of the detail specification, date of issue and any further information required by the national system.

(3) The number and issue number of the IEC or National Generic Specification.

(4) The IEC number of the blank detail specification.

Identification of the potentiometer

(5) A short description of the type of potentiometer.

(6) Information on typical construction (when applicable) for example: non-wirewound, lead-screw actuated.

Note. -When the potentiometer is not designed for use in printed board applications this shall be clearly stated in the detail specification in this position.

(7) Outline drawing with main dimensions which are of importance for interchangeability and/or reference to the national or international documents for outlines. Alternatively, this drawing may be given in an appendix to the detail specification.

(8) Application or group of applications covered and/or assessment level.

Note. -The assessment level(s) to be used in a detail specification shall be selected from the sectional specification, Sub-clause 3.3.3. This implies that one blank detail specification may be used in combination with several assessment levels, provided the grouping of the tests does not change.

(9) Reference data on the most important properties, to allow comparison between the various potentiometer types.

(1)	IEC 393-2-1-XXX QC 410101-XXX (2)
ELECTRONIC COMPONENTS OF ASSESSED QUALITY IN ACCORDANCE WITH: (3)	IEC 393-2-1 QC 410101 (4)
	LEAD-SCREW ACTUATED AND ROTARY PRESET POTENTIOMETERS (5)
Outline drawing and dimensions: (... angle projection) (7) (When necessary the dimensions may be given in an Appendix to the detail specification)	Typical construction: (6)
Terminal connections:	Assessment level(s): E (8)

Information on the availability of components qualified to this detail specification is given in the Qualified Products List.

(9)

TABLE I

Style	Rated dissipation at 70 °C (W)	Limiting element voltage (V d.c. or a.c. r.m.s.)	Isolation voltage (V d.c. or a.c. peak)	
			Normal air pressure	Low air pressure

SECTION ONE - GENERAL DATA

1. GENERAL DATA

1.1 RECOMMENDED METHOD(S) OF MOUNTING (to be inserted)

(See Sub-clause 1.4.2 of IEC Publication 393-2).

1.2 DIMENSIONS

(When necessary the dimensions may be given in an Appendix to the detail specification).

All dimensions are in millimetres or inches and millimetres.

1.3 RATINGS AND CHARACTERISTICS

Resistance range*	The range of values in each style is given in the Qualified Products List.
Tolerances on rated resistance	± ... %
Resistance law	...
Temperature characteristic of resistance (20 °C to 70 °C) ($\Delta R/R$)	$\leq$ ± ...%
Temperature coefficient	$\leq$ ... 10^{-6}/°C
Climatic category	-/-/-
Low air pressure	8.5 kPa (85 mbar)
Limits of resistance change (after 1 000 h electrical endurance test)	±(...%R + ... Ω)
Starting torque	... mN.m to ... mN.m
Total mechanical travel	... ± ... turns or ...
Limiting moving contact current	... mA
Theoretical resolution (for wirewound types only)	... %

*The preferred values are those of the E-series of IEC Publication 63.

1.3.1 DERATING

Potentiometers covered by this specification are derated according to the following curve:

(A suitable curve to be included
in the detail specification)

Note. -See also Sub-clause 2.2.3 of the sectional specification.

1.4 RELATED DOCUMENTS

Generic Specification:	IEC Publication 393-1 (1989): Potentiometers for use in electronic equipment. Part 1: Generic Specification.
Sectional Specification:	IEC Publication 393-2 (1989): Potentiometers for use in electronic equipment, Part 2: Sectional Specification: Lead-screw actuated and rotary preset potentiometers.

1.5 MARKING

The marking of the component and package shall be in accordance with the requirements of IEC Publication 393-2, Sub-clause 1.5.

Note. -The details of the marking of the component and package shall be given in full in the detail specification.

1.6 ORDERING INFORMATION

Orders for potentiometers covered by this specification shall contain, in clear or in coded form, the following minimum information:

a) Rated resistance and tolerance on rated resistance.

b) Resistance law (if other than linear).

c) Number and issue reference of the detail specification and style reference.

1.7 CERTIFIED RECORDS OF RELEASED LOTS

Required/not required.

1.8 ADDITIONAL INFORMATION (not for inspection purposes)

(The detail specification may include information such as circuit diagrams, curves, drawings and notes needed for the clarification of the detail specification).

1.9 ADDITIONAL OR INCREASED SEVERITIES OR REQUIREMENTS TO THOSE SPECIFIED IN THE GENERIC AND/OR SECTIONAL SPECIFICATION

Note. -Additions or increased requirements should be specified only when essential.

SECTION TWO - INSPECTION REQUIREMENTS

2. INSPECTION REQUIREMENTS

2.1 Procedures

2.1.1 For Qualification Approval the procedures shall be in accordance with the Sectional Specification, IEC Publication 393-2, Sub-clause 3.2.

2.1.2 For Quality Conformance Inspection the test schedule (Table II) includes sampling, periodicity, severities and requirements. The formation of inspection lots is covered by Sub-clause 3.3.1 of the Sectional Specification.

For the quality conformance inspection the values representative of the whole approved range shall be tested within one year (Groups A, B and C only).

Note. -When drying is called for, Procedure I of Sub-clause 4.3 of the Generic Specification, IEC Publication 393-1 shall be used.

TABLE II

Notes 1. -Sub-clause numbers of tests and performance requirements refer to the generic specification for potentiometers, IEC Publication 393-1, except for some severities for environmental tests and limits of change in resistance or output ratio, which have to be taken from the relevant clauses of the sectional specification, IEC Publication 393-2.

2. -Inspection levels and AQL's are selected from IEC Publication 410: Sampling Plans and Procedures for Inspection by Attributes.

3. -In this table:

p = periodicity (in months)
n = sample size
c = acceptance criterion (permitted number of defectives)
D = destructive
ND = non-destructive
IL = inspection level } IEC Publication 410
AQL = acceptable quality level }

Sub-clause number and Test (see Note 1)	D or ND	Conditions of test (see Note 1)	IL (see Note 2)	AQL (see Note 2)	Performance requirements (see Note 1)
GROUP A INSPECTION (lot-by-lot)					
Sub-group A1	ND		II	4.0%	
4.4.1 Visual examination					As in 4.4.1 Legible marking and as specified in 1.5 of this specification
Sub-group A2	ND		II	1.0%	
4.6 Element resistance					As in 4.6.3
Sub-group A3	ND		S-2	4.0%	
4.4.2 Dimensions (gauging)					As specified in this specification

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Sub-clause number and Test (see Note 1)	D or ND	Conditions of test (see Note 1)	IL	AQL	Performance requirements (see Note 1)
			(see Note 2)		
Sub-group A4	ND		S-3	1.0%	
4.7 Terminal resistance		Resistance a to b Resistance b to c			≤ ... Ω ≤ ... Ω
4.5 Continuity					As in 4.5.2
4.15 Rotational noise		Method B, $\Delta\theta_0$: ...			≤ ... Ω
4.12 Voltage proof		(Insulated potentiometers only) (For mounting method see 1.1 of this specification and Note 8) Normal air pressure			As in 4.12.5
GROUP B INSPECTION (lot-by-lot)					
Sub-group B1	D		S-2	1.5%	
4.18 Starting torque					As specified in this specification
4.31 Sealing (if applicable)		Temperature: 85 °C to 90 °C			As in 4.31.3
Sub-group B2	ND		S-2	1.5%	
4.32 Solderability		Solder bath method Temperature: 235 ± 5 °C Duration: 2 ± 0.5 s			Good tinning as evidenced by free flowing of the solder with wetting of the terminations
4.45 Solvent resistance of the marking (if applicable)		Solvent: ... Solvent temperature: ... Method 1 Rubbing material: cotton wool Recovery: ...			Legible marking

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Sub-clause number and Test (see Note 1)	D or ND	Conditions of test (see Note 1)	Sample size & criterion of acceptability (see Note 3) p	n	c	Performance requirements (see Note 1)
GROUP C INSPECTION (periodic)						
Sub-group C1	ND		3	8	1	
4.14 Temperature characteristic of resistance		Lower category temperature/20 °C 20 °C/70 °C 20 °C/Upper category temperature				$\frac{\Delta R}{R} \leqslant \ldots\%$ $\frac{\Delta R}{R} \leqslant \ldots\%$ $\frac{\Delta R}{R} \leqslant \ldots\%$
4.21 Locking torque (if applicable)		Output ratio				$\Delta \frac{U_{ab}}{U_{ac}} \leqslant \ldots\%$
		Visual examination				As in 4.21.3
4.20 End stop torque		- For types fitted with end stops: As specified in 4.20.1 Not less than five times the upper limit of the starting torque (unless otherwise stated by the detail specification)				As in 4.20.1
		- For types fitted with slipping clutches: As specified in 4.20.2				As in 4.20.2
4.22 Thrust and pull on spindle		Only the thrust shall be applied. The pull is not applicable				
		- Half of the specimens: As specified ir 4.22.2 Continuity				As in 4.22.2
		- Remaining specimens: As specified in 4.22.3				$\Delta \frac{U_{ab}}{U_{ac}} \leqslant \ldots\%$
4.4.4 Total mechanical travel		- Lead-screw styles: Effective operating turns ...				$\geqslant$70% of total mechanical travel
		- Rotary styles				As specified in this specification

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Sub-clause number and Test (see Note 1)	D or ND	Conditions of test (see Note 1)	Sample size & criterion of acceptability (see Note 3)			Performance requirements (see Note 1)
			p	n	c	
4.4.6 Effective electrical travel		- Lead-screw styles:				$\geqslant$ 70% of the measured total mechanical travel
		- Rotary styles				As specified in this specification
Sub-group C2A Part of the sample of Sub-group C2	D		3	7		
4.30 Robustness of terminations		The test appropriate to the type of terminations				
		Visual examination				As in 4.30.8
		Element resistance				$\Delta R \leqslant \pm(\ldots\% R + \ldots \Omega)$
4.33 Resistance to soldering heat		- For potentiometers designed for printed board applications: Method 1A - For other potentiometers: Method 1B				
		Element resistance				$\Delta R \leqslant \pm(\ldots\% R + \ldots \Omega)$
		Terminal resistance:				
		Resistance a to b				$\leqslant \ldots \Omega$
		Resistance b to c				$\leqslant \ldots \Omega$
4.44 Component solvent resistance (if applicable)		Solvent: ... Solvent temperature: ... Method 2				See detail specification
		Recovery: ...				
4.31 Sealing (if applicable)		Temperature: 85 °C to 90 °C				As in 4.31.3

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Sub-clause number and Test (see Note 1)	D or ND	Conditions of test (see Note 1)	Sample size & criterion of acceptability (see Note 3)			Performance requirements (see Note 1)
			p	n	c	
Sub-group C2B Other part of sample of Sub-group C2	D		3	6		
4.34 Change of temperature		See Note 4 θ_A = Lower category temperature θ_B = Upper category temperature				
		Visual examination				As in 4.34.5
		Output ratio				$\Delta \frac{U_{ab}}{U_{ac}} \leqslant \ldots \%$
		Element resistance				$\Delta R \leqslant \pm(\ldots \% R + \ldots \Omega)$
4.36 Bump (or shock) (see Note 5)		For mounting method see 1.1 of this specification				
		Acceleration: 390 m/s^2				
		Number of bumps: 4 000				
		Visual examination				As in 4.36.3
		Element resistance				$\Delta R \leqslant \pm(\ldots \% R + \ldots \Omega)$
4.37 Shock (or bump) (see Note 5)		For mounting method see 1.1 of this specification				
		Pulse shape: half-sine				
		Acceleration: 490 m/s^2				
		Pulse duration: 11 ms				
		Visual examination				As in 4.37.3
		Element resistance				$\Delta R \leqslant \pm(\ldots \% R + \ldots \Omega)$
4.35 Vibration (see Note 6)		For mounting method see 1.1 of this specification				
		Procedure B4				

Notes 4 to 8 on page 37

Sub-clause number and Test (see Note 1)	D or ND	Conditions of test (see Note 1)	Sample size & criterion of acceptability (see Note 3)			Performance requirements (see Note 1)
			p	n	c	
		Frequency range: ... Hz to ... Hz				
		Amplitude: 0.75 mm or acceleration 98 m/s^2 (whichever is the less severe)				
		Sweep endurance				
		Total duration: 6 h See Note 4				
		Measurements during test Electrical continuity (As specified in 4.35.4)				There shall be no discontinuity $> 100\ \mu s$
		Final measurements Visual examination				As in 4.35.5
		Output ratio				$\Delta \frac{U_{ab}}{U_{ac}} \leqslant \dots \%$
		Element resistance				$\Delta R \leqslant \pm(\dots \% R + \dots \Omega)$
Sub-group C2 Combined sample of specimens of Sub-groups C2A and C2B	D		3	13	2	
4.38 Climatic sequence						
- Dry heat		Visual examination				As in 4.38.2.2
- Damp heat, cyclic, Test Db, first cycle						
- Cold		Starting torque				... mN.m to ... mN.m
- Low air pressure		8.5 kPa (85 mbar)				
		Voltage proof (Insulated potentiometers only) (For mounting method see 1.1 of this specification and Note 8)				As in 4.38.5.3

Notes 4 to 8 on page 37

Sub-clause number and Test (see Note 1)	D or ND	Conditions of test (see Note 1)	Sample size & criterion of acceptability (see Note 3) p	n	c	Performance requirements (see Note 1)
- Damp heat, cyclic, Test Db, remaining cycles						
- D.C. load		See Note 7				
- Isolation voltage		See Note 7				As in 4.38.8
- Final measurements		Visual examination				As in 4.38.10.1
		Element resistance				$\Delta R \leqslant \pm(\ldots\%R + \ldots\Omega)$
		Insulation resistance (Insulated potentiometers only) (For mounting method see 1.1 of this specification and Note 8)				$\geqslant$100 MΩ
		Continuity				As in 4.5.1
		Starting torque				... mN.m to ... mN.m
		Voltage proof (Insulated potentiometers only) (For mounting method see 1.1 of this specification and Note 8)				As in 4.38.10.7
Sub-group C3	D		3	8	1	
4.43.2 Electrical endurance at 70 °C		Duration: 1 000 h - Loaded between a and c				
		Examination at 48 h, 500 h and 1 000 h:				
		Visual examination				As in 4.43.2.6 1)
		Element resistance				$\Delta R \leqslant \pm(\ldots\%R + \ldots\Omega)$
		- Loaded between a and b				
		Examination at 48 h, 500 h and 1 000 h:				

Notes 4 to 8 on page 37

Sub-clause number and Test (see Note 1)	D or ND	Conditions of test (see Note 1)	Sample size & criterion of acceptability (see Note 3)			Performance requirements (see Note 1)
			p	n	c	
		Visual examination				As in 4.43.2.6 1)
		Resistance a to b				$\Delta R \leqslant \pm(\ldots\% R + \ldots\Omega)$
		Element resistance				$\Delta R \leqslant \pm(\ldots\% R + \ldots\Omega)$
		All specimens				
		Examination at 1 000 h: Insulation resistance (Insulated potentiometers only) (For mounting method see 1.1 of this specification and Note 8)				$\geqslant 1\ \mathrm{G}\Omega$
		Rotational noise, Method B, $\Delta\theta_0$: ...				$\leqslant \ldots\Omega$
Sub-group C4	D		3	8	1	
4.40 Mechanical endurance (potentiometers)		Number of cycles: 200				
		Rate: - Rotary types: 5 to 10 cycles per minute - Lead-screw types: ...				
		Visual examination				As in 4.40.6
		Element resistance				$\Delta R \leqslant \pm(\ldots\% R + \ldots\Omega)$
		Starting torque				... mN.m to ... mN.m
		Rotational noise, Method B, $\Delta\theta_0$: ...				$\leqslant \ldots\Omega$
GROUP D INSPECTION (periodic)						
Sub-group D1	D		12	8	1	
4.39 Damp heat, steady state		1) Sub-clause 4.39.2.1 1st group: 2 specimens 2nd group: 3 specimens 3rd group: 3 specimens				

Notes 4 to 8 on page 37

Sub-clause number and Test (see Note 1)	D or ND	Conditions of test (see Note 1)	Sample size & criterion of acceptability (see Note 3)			Performance requirements (see Note 1)
			p	n	c	
		2) Sub-clause 4.39.2.2 1st group: 4 specimens 2nd group: 4 specimens				
		D.C. load (See Note 7)				
		Isolation voltage (See Note 7) (For mounting method see 1.1 of this specification and Note 8)				As in 4.39.4
		Final measurements				
		Visual examination				As in 4.39.6.1
		Element resistance				$\Delta R \leqslant \pm(\ldots\% R + \ldots\Omega)$
		Insulation resistance (Insulated potentiometers only) (For mounting method see 1.1 of this specification and Note 8)				$\geqslant$100 MΩ
		Continuity				As in 4.5.1
		Starting torque				... mN.m to .... mN.m
		Rotational noise,				
		Method B, $\Delta\theta_0$:				$\leqslant \ldots \Omega$
		Voltage proof (Insulated potentiometers only) (For mounting method see 1.1 of this specification and Note 8)				As in 4.39.6.8
Sub-group D2	D		36	8	1	
4.43.3 Electrical endurance at upper category temperature		Duration: 1 000 h				
		- Loaded between a and c				
		Examination at 48 h, 500 h and 1 000 h:				
		Visual examination				As in 4.43.3.7 1)

Notes 4 to 8 on page 37

Sub-clause number and Test (see Note 1)	D or ND	Conditions of test (see Note 1)	Sample size & criterion of accepta-bility (see Note 3)			Performance requirements (see Note 1)
			p	n	c	
		Element resistance				$\Delta R \leqslant \pm(..\ \%R + \ldots \Omega)$
		Loaded between a and b				
		Examination at 48 h, 500 h and 1 000 h:				
		Visual examination				As in 4.43.3.7 1)
		Resistance a to b				$\Delta R \leqslant \pm(\ldots \%R + \ldots \Omega)$
		Element resistance				$\Delta R \leqslant \pm(\ldots \%R + \ldots \Omega)$
		All specimens				
		Examination at 1 000 h				
		Insulation resistance (Insulated potentiometers only) (For mounting method see 1.1 of this specification and Note 8)				$\geqslant 1\ \mathrm{G}\Omega$
Sub-group D3	ND		36	8	1	
4.4.3 Dimensions (detail)						As specified in this specification
Sub-group D4	D		36	8	1	
4.43 Electrical endurance at temperatures other than 70 °C (if applicable)		(This sub-group is only applicable if a derating curve other than those shown in 2.2.3 of the sectional specification is claimed in the detail specification)				
		Duration: 1 000 h				
		- loaded between a and c Examination at 48 h, 500 h and 1 000 h:				

Notes 4 to 8 on page 37

Sub-clause number and Test (see Note 1)	D or ND	Conditions of test (see Note 1)	Sample size & criterion of acceptability (see Note 3) p	n	c	Performance requirements (see Note 1)
		Visual examination				As in 4.43.1.6 1)
		Element resistance				$\Delta R \leqslant \pm(\ldots\% R + \ldots\Omega)$ (As for Sub-group C3)
		- Loaded between a and b				
		Examination at 48 h, 500 h and 1 000 h:				
		Visual examination				As in 4.43.1.6 1)
		Resistance a to b				$\Delta R \leqslant \pm(\ldots\% R + \ldots\Omega)$ (As for Sub-group C3)
		Element resistance				$\Delta R \leqslant \pm(\ldots\% R + \ldots\Omega)$
		All specimens				
		Examination at 1 000 h:				
		Insulation resistance (Insulated potentiometers only) (For mounting method see 1.1 of this specification and Note 8)				$\geqslant 1\ \text{G}\Omega$

Notes 4 to 8 on page 37

Notes 4. -The requirements for preset potentiometers in the test method shall apply.

5. -The bump and shock test are considered to be alternatives. The detail specification shall indicate which test applies.

6. -This test is applicable to potentiometers of climatic categories 25/-/-, 40/-/-, 55/-/- and 65/-/-.

7. -The d.c. load test and the isolation voltage test are considered as alternatives. The detail specification shall indicate which test applies.

8. -For method of mounting see Sub-clause 4.12 or 4.13, as appropriate, of IEC Publication 393-1, with the following details:

   1) Components designed as "mounted by the body" shall be mounted as in Sub-clause 4.12.1.

   2) Components designed as "mounted by the terminations" shall be tested whilst mounted by their terminations on a printed board, irrespective of whether any holes exist which could permit mounting by the body.